REMARKS

In view of the above amendments and the following remarks, reconsideration and further examination are requested.

As required by the Examiner, a substitute Declaration and Power of Attorney properly including the Applicants' post office addresses is submitted herewith. As a result, withdrawal of this requirement is respectfully requested.

The specification and abstract have been reviewed and revised to make a number of editorial revisions. Due to the number of changes involved, a substitute specification and abstract have been prepared and are submitted herewith. No new matter has been added. Enclosed is a marked-up copy of the original specification and abstract labeled "***Version with Markings to Show Changes Made***" indicating the changes incorporated into the substitute specification and abstract.

The drawings have been objected to under 37 CFR 1.83(a) as not showing every feature of the invention specified in the claims. Specifically, the Examiner has indicated that the Figures must show two flat plates. Proposed drawings amendments to Figures 1-4 are submitted herewith under a separate cover letter. Figure 1 has been amended so as to properly label the two flat plates. These drawings amendments are editorial in nature and do not add new matter to the application. As a result, withdrawal of the objection to the drawings is respectfully requested. In addition, new formal drawings including the above-mentioned amendments to Figures 1-4 are also submitted herewith under a separate cover letter.

Claim 1 has been rejected under 35 U.S.C. 102(b) as being anticipated by Bauer (US 4,662,568). Claims 2-5 have been indicated as containing allowable subject matter. The Applicants would like to thank the Examiner for this indication of allowable subject matter.

Claim 2 has been amended so as to be drafted into independent form. As a result, it is apparent that claims 2-5 are now in condition for allowance.

In addition, claims 1-5 have been amended so as to include a number of minor editorial revisions. These revisions have been made to place the claims in better U.S. form. None of these amendments have been made to narrow the scope of protection of the claims, nor to address issues related to patentability and therefore, these amendments should not be construed as limiting

the scope of equivalents of the claimed features offered by the Doctrine of Equivalents. Enclosed herewith is a marked-up copy of claims 1-5 labeled "***Version with Markings to Show Changes Made***" indicating the changes incorporated therein.

The above-mentioned rejection of claim 1 is respectfully traversed and submitted to be inapplicable for the following reasons.

Claim 1 is patentable over Bauer, relied upon in the rejection, since claim 1 recites a method of stabilizing a slit fluid jet including, in part, superimposing a fluid jet accompanied with a flip-flop phenomenon upon at least one surface of the slit fluid jet. Bauer fails to disclose or suggest superimposing a fluid jet accompanied with a flip-flop phenomenon upon at least one surface of a slit fluid jet.

Bauer discloses a spray nozzle with an oscillator 10 and a spray forming output chamber 12. The oscillator 10 includes an inlet 14 for directing a flowing liquid stream into an oscillator chamber 16. The liquid stream entering the chamber 10 is influenced by vortices formed in the chamber 10 so that the liquid stream is broken up into two liquid flows of varying amplitude and different phase. The spray forming chamber 12 has a pair of peripheral walls 18 and 20 which terminate at an opening 22. The two fluid flows from the oscillator chamber 10 are directed into the chamber 12 substantially parallel to the walls 18 and 20 and create vortex flows of varying magnitude in the chamber 12. The vortex action in the chamber 12 causes the resultant flow to issue from the opening 22 in the form of a continuous fluid jet 23 which is swept back and forth. (See column 3, lines 36-60 and Figures 1A-1C).

As can be clearly seen from Figure 1A, Bauer discloses a nozzle that is operable to spray a fluid jet in a zig-zag pattern. Further, the spray nozzle is designed so that the swept fluid jet 23 breaks up into a number of drops 37 and further into droplets 39 after leaving the nozzle. On the other hand, the present invention as recited in claim 1 superimposes a fluid jet accompanied with a flip-flop phenomenon upon at least one surface of a slit fluid jet and thereby forms a stable slit fluid jet. It is apparent that the spray nozzle disclosed in Bauer does not generate a stable slit fluid jet since it is intentionally designed to cause the fluid jet 23 to break into a number of drops 37 and droplets 39. As a result, it is apparent that Bauer fails to disclose or suggest the present invention as recited in claim 1.

Because of the above-mentioned distinctions, it is believed clear that claims 1-5 are not anticipated by Bauer. Furthermore, it is submitted that the distinctions are such that a person having ordinary skill in the art at the time of invention would not have been motivated to modify Bauer or to make any combination of the references of record in such a manner as to result in, or otherwise render obvious, the present invention as recited in claims 1-5. Therefore, it is submitted that claims 1-5 are clearly allowable over the prior art of record.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. The Examiner is invited to contact the undersigned by telephone if it is felt that there are issues remaining which must be resolved before allowance of the application.

Respectfully submitted,

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Version with Markings to Show Changes Made

DESCRIPTION

METHOD AND DEVICE FOR STABILIZING SLIT FLUID JET

Technical Field

The invention ~~of this application~~ relates to a method of stabilizing a slit fluid jet and a device therefor. More particularly, the invention ~~of this application~~ concerns a method of stabilizing a slit fluid jet and a device therefor which are useful, especially for preventing fluid and solid from entering into a space of control from outside ~~it~~, or for preventing fluid and solid from escaping ~~going out~~ from the space of control to the ~~into~~ outside ~~it~~.

Background Art

In a prescribed space of control of a building structure, a mechanical apparatus, etc., a slit fluid jet has hitherto been used as means for preventing fluid and solid from entering into the space of control from outside ~~it~~, or for preventing fluid and solid from escaping ~~going out~~ from the space of control to the ~~into~~ outside ~~it~~.

For example, in a general type of building structure, an air curtain that is a kind of slit fluid jet is ejected at each of the inlet and outlet thereof to thereby make effective the zoning between the space of control and the external air, thereby the air-conditioning efficiency is successfully enhanced.

Also, in a processing apparatus for frozen food, air

curtains are ejected from the surroundings of a processing part thereof, to thereby form a space of cool air for the low-temperature preservation of foodstuff.

Further, in a machine tool, liquid curtains or shower curtains are ejected from the surroundings of a machining part thereof, to thereby prevent cut shavings from being scattered, or splashing out, from the space of machining. ~~And~~ this slit fluid jet such as the air curtain, liquid curtain, or shower curtain is formed by ejecting fluid from an apparatus using a pair of smooth flat surfaces or curved surfaces or an apparatus wherein ~~the~~ nozzles are arrayed.

However, although the above-described slit fluid jet has greatly contributed to forming the space of control, it has a lot of problems from the viewpoint of efficiently forming a large space of control.

Namely, to form a large space of control through the use of such a slit fluid jet, it is necessary to increase the velocity of that slit fluid jet. However, generally, increasing the velocity of the fluid results in ~~that~~ the instability of the film of the fluid increasing ~~increases~~. This raises the problem that the filmy fluid of the slit fluid jet is ~~becomes~~ likely to be broken.

This likeliness to break of the fluid film of the slit fluid jet is attributable to the turbulence component (variable speed component) of the fluid ~~has~~. This turbulence component causes the exfoliation of the shearing layer on the inner wall of the slit, the creation of the exfoliation vortexes, the entrapment of air at the outlet of the slit, etc. It thereby

makes the thickness of the fluid film of the slit fluid jet uneven, with the result that the fluid film becomes broken due even to a small intensity of disturbance.

On this account, as one of the countermeasures against this, it is thought to be possible ~~available~~ to decrease the velocity of the slit fluid jet to thereby stabilize the film of the fluid. However, making the velocity of the fluid low results in that the fluid film is broken even by a small intensity of disturbance.

Also, further, the above-described likeliness of breaking ~~to break~~ ~~of~~ the fluid film becomes serious as the distance as measured from the slit opening increases. Namely, as the distance from the slit opening increases, the thickness of the slit fluid jet becomes very small, so that it is easily broken due even to a very small magnitude of disturbance.

In order to take measures to address ~~toward~~ the problem of the above-described likeliness to break ~~of~~ the fluid film, usually ~~nowadays~~, in general, ~~making thick~~ the fluid film of the slit fluid jet is made thick ~~done~~. However, this means increasing the flow rate of the slit fluid jet, but this becomes a factor causing a rise in the running cost.

Whereupon, this ~~the~~ invention ~~of this application~~ has been made in view of the shortcomings of the conventional techniques mentioned above, and an object of the present invention is to provide a method of stabilizing a slit fluid jet and a device therefor which enable a stable fluid film to be formed from an ~~the~~ ejection opening of the slit over a long distance with the ~~that~~ sli~~d~~t fluid jet being not broken.

Summary ~~Disclosure~~ of the Invention

The invention ~~of this application~~, as means for solving the above-described problems, first, provides a method of stabilizing a slit fluid jet, comprising superimposing a fluid jet accompanied with a flip-flop phenomenon upon one, or both, of the surfaces of a slit fluid jet and thereby forming a stable ~~said~~ slit fluid jet.

Further, the invention ~~of this application~~, secondly, provides a stabilizing device for stabilizing a slit fluid jet, the stabilizing device being adapted to stabilize the slit fluid jet. The stabilizing device is ~~comprising being~~ equipped with two flat plates that oppose each other with a prescribed gap in between. One of the flat plates of the slit having an opposing surface that is smooth, and the other having a network structure that has a plurality of crossed grooves that are crossed like a letter x. The invention ~~It~~, thirdly, provides a stabilizing device for stabilizing the slit fluid jet, wherein at an outlet of the fluid there are disposed flow passages of the network structure so that the fluids may be merged ~~in~~. The invention ~~And it~~, fourthly, provides a stabilizing device for stabilizing the slit fluid jet, wherein a ~~the~~ length between an detouched vortex, occurring at a ~~the~~ back of the crossed groove portion, and a point to where ~~that~~ the detouched vortex has been shifted is equal to or greater than the length of one side of a diamond-shaped protruding portion that is formed by the x-shaped grooves.

Brief Description of Drawings

Fig. 1 is a schematic diagram illustrating the present invention;

Fig. 2 is a plan view illustrating a flow structure of the present invention;

Fig. 3 is a plan view illustrating a flow structure of the present invention; and

Fig. 4 is a schematic diagram illustrating a flip-flop phenomenon that is a basic conception of the present invention.

It is to be noted that the symbols in the figures represent the following~~,~~:

~~10~~ flat plate 10,
~~11~~ crossed groove 11,
~~12~~ buffer region 12,
~~13~~ fluid supply pipe 13,
~~14~~ air bubbles 14, and
~~15~~ vortex 15.

~~Best Mode for Carrying out~~ Detailed Description of the Invention

Generally ~~saying~~ speaking, ~~the~~ instability of ~~the~~ a fluid film is attributable to ~~the~~ turbulence of the flow, i.e., the variable speed component. A fluid necessarily contains this variable speed component. Therefore, extreme difficulties are encountered in eliminating that turbulence.

On that account, the present invention ~~of this application has~~ ~~performed~~ performs hydrodynamic control with respect to the conventional simple slit fluid jet. More specifically, the invention ~~of this~~

~~application~~, in order to make uniform the non-uniformity of the fluid film thickness that results from the turbulence of the fluid, has formed a fluid film that has a two-layer structure of a slit fluid jet flow and a flip-flop flow. The invention of this application has resultantly added a mechanism for absorbing, with the lapse of time, the variable speed component that is contained in the slit fluid jet flow. In this respect, the invention of this application has a great characterizing feature.

In the process of reaching the present invention, the inventors had ~~of this application have~~ initially thought that, if a phenomenon peculiar to a fluid that occurs utilizing the variable speed in the fluid ~~it~~ as the energy of it is superimposed upon the slit fluid jet flow, a stable fluid film will be formed. Based on this idea, the inventors have ~~of this application has~~ conceived the fact that a~~n~~ detouched vortex, which appears in the flow at the back of a substance and which is typically represented by a Kalman vortex, periodically occurs due to the existence of the variable speed component.

Namely, when a substance has flow passages that have been disposed in a zigzag way, at each of the crossed portions thereof there occurs a ~~the~~ flip-flop phenomenon in which ~~that~~ periodic vibrations occur in the radial direction of the flow. This flip-flop phenomenon is the mechanism for absorbing the variable speed component with the lapse of time, and ~~that~~ the ~~that~~ flip-flop phenomenon is known as converting that variable speed component to the periodic vibrations that occur in the radial direction

of the main flow.

~~And~~, the inventors ~~of this application~~ have applied the ~~that~~ flip-flop phenomenon to actual stabilizing of the slit fluid jet flow, and have thereby come to the present invention.

Regarding the method of stabilizing the slit fluid jet flow according to the present invention, more specifically, if causing a fluid to be ejected from the slit opening to thereby form a slit fluid jet, superimposing a crossed flow, which is followed by the flip-flop phenomenon, upon this slit flow jet, and thereby causing the variable speed component energy of the slit fluid jet to be absorbed into the vibration component of the flip-flop crossed flow, a stable fluid film is formed. The flip-flop crossed flow is formed by means of a network terminal formed by a plurality of crossed grooves and causes the jet flow to periodically vibrate in the radial direction of the grooves ~~it~~. This periodic vibration is caused by the flow of the fluid and the ~~this~~ periodic vibration is amplified by the interaction between the ejected pieces of flow. This groove flow structure that is constructed of a plurality of groove flows acts to convert the turbulent component of the fluid into the periodic vibration component that is active in the radial direction of the grooves ~~it~~.

Namely, the network structure that is comprised of the flow passages formed by the grooves controls the turbulent component of the fluid, ~~and~~ causes the flip-flop phenomenon to occur at each of the points of merging of the groove flows, and causes each of the groove flows to periodically vibrate in the radial direction of the groove.

The slit fluid jet upon which this flip-flop crossed flow is superimposed becomes stabilized. This is because, if the jet flow followed by the flip-flop phenomenon exists on any one surface of the liquid film of the slit fluid jet, the component of fluctuation of the slit fluid jet is converted into the flip-flop phenomenon energy that is active upon that jet.

A device for stabilizing the slit fluid jet according to the present invention includes, as an aspect, the one that has been illustrated in Fig. 1.

This stabilizing device for the slit fluid jet having surfaces is constructed of two flat plates (10) that oppose each other with a prescribed spacing in between. ~~The~~ An inside of one of ~~those~~ the flat plates (10) is smooth while the other thereof has a network structure that has a plurality of crossed grooves (11), the configuration of ~~that~~ which is shaped like a letter x.

~~And~~ preferably, the flow passages of the network structure are located so that the pieces of fluid may merge in the flow-out opening of the fluid, and it is also preferable that the distance from an detouched vortex appearing at the back of each of the crossed portions to the point to which that detouched vortex has been shifted be equal to or greater than one side of the diamond-shaped protruding portion formed by the x-shaped grooves.

Incidentally, although it is preferable that the flat plates (10,10) ~~(10)~~ be flat surface members, they may be curved surface members. In that case, ~~that~~ a ~~the~~ clearance that is a ~~the~~ gap between the opposing members be equal, preferably, is made a ~~the~~

requirement.

Also, a buffer region (12) for the fluid may be formed at one side of the clearance. The fluid that has been supplied from a fluid supply pipe (13) is allowed to flow between the paired opposing members, and this fluid is ejected as a slit ~~slid~~ fluid jet.

Fig. 2 is a view illustrating, as a plan view, a ~~the~~ member inside the slit that has a network structure. This member has provided therein as the passages of fluid a plurality of grooves 1a, b, c, ..., n and a plurality of grooves 2a, b, c, ..., n in a ~~the~~ way in which both form net meshes. The respective ones of the grooves 1a, b, c, ..., n are provided at equal intervals and in parallel with one another, and the respective ones of the grooves 2a, b, c, ..., n are also provided in the same way.

A plurality of grooves that are included in the angular region (A) defined between the flow and the main axis and a plurality of grooves that are included in the angular region (-A) that has been similarly defined are provided each in paired relationship with each other so that the pieces of fluid may merge together to go out from the ejection opening. Namely, they are provided so that the fluid that has been supplied from an inlet portion (IL) of the fluid may merge together at an outlet portion (OL). As a result of this, the pieces of fluid ~~they~~ make out, at the merging portion, the fluid jet having the periodic vibration component that is active in the right and left directions of the drawing sheet.

In Fig. 3, since the fluid is being supplied under a

prescribed pressure from the buffer region, the fluid flows into the groove ~~1c~~ 2c as a fluid jet L1a and the fluid flows ~~from~~ into the groove 1b as a fluid jet L1b. ~~And~~ the two pieces of liquid flow merge at a crossed passage M1. As a result of this merging, the flow speed is accelerated, whereby at this crossed portion there is a point of energy supply where the flow speed is ~~maximum~~ maximized and the pressure is ~~minimum~~ minimized. At the back of that crossed portion, there are formed asymmetrical detouched vortexes. These asymmetrical detouched vortexes at the back of that crossed portion are affected by the point of energy supply and, with the lapse of time, their position and shape are changed, whereby those asymmetric detouched vortexes alternately appear at the positions of V1 and V2 (see Fig. 4 ~~too~~ as well). The period in which they alternately appear depends upon ~~the~~ a Strouhal number that is almost in inverse proportion to ~~the~~ a Reynolds number.

A further explanation will now be given of the details of the flip-flop phenomenon that is the important basic principle of the present invention.

This flip-flop phenomenon is based on the utilization of the fact that the speed fluctuation at the back flow of a substance has periodicity. For example, when there is a substance in the course of ~~the~~ flow whose speed is V, the vortexes that mutually rotate in opposite directions alternately occur from that substance and flow~~s~~ backward. For this reason, periodicity occurs in the fluctuation of speed in the back flow of the substance. The frequency at which those vortexes occur is given by the dimensionless Strouhal number $St = f\,L/V$, where the f represents

the frequency in the periodic fluctuation phenomenon of the fluid; L represents the projection length of the substance toward the surface vertical to the flow (in general, the significant length of the substance configuration, ~~If~~ and if that substance is a circular columnar member, the diameter of it); and V represents the speed of the fluid. For example, that ~~the~~ an electric wire ~~is sounded~~ sounds cracked on ~~the~~ a day with strong wind ~~of day~~ is the phenomenon that that vortex is released.

In general, the Strouhal number depends upon the configuration of the substance. In the case of, for example, a circular columnar member, it is known that when the Reynolds number is from 1,000 to 100,000, the Strouhal number is 0. 2.

In the natural world, there is a living being that well utilizes the ~~nature~~ fact that periodicity exists in the vortexes at the back flow of a substance. Lighthill describes in his "~~(~~Mathematical Biofluid mechanics, Society for Industrial and Applied Mathematics, 1975~~)~~" as follows. A group of fish~~es~~ that takes a network structure of x-shaped meshes, which while being situated at a diagonal position are swimming at the back of other fish, tends to decrease the resistance applied to that group of forwardly moving fish~~es~~ through the use of the periodic vortex flows that are released from the fish that is ~~going~~ ahead.

Especially, the positional relationship in the network structure of x-shaped meshes acts to make the vortexes ~~keep having~~ maintain their periodicity, while making the energy thereof ~~keep~~ kept increased. Accordingly, it is thought that the network structure of x-shaped meshes, which is formed by a plurality of crossed grooves, will

be useful, from the viewpoint of such a natural phenomenon as well.

Next, using Fig. 4, an explanation will be given of the flip-flop phenomenon that occurs in the flow in the network structure of x-shaped meshes. In Step 1, there is illustrated a state where an air bubble (14) begins to occur at a ~~the~~ right/upper position of the network structure of x-shaped meshes. Step 2 illustrates a state where 0.3 second has lapsed from Step 1. In this state, that air bubble becomes large and resultantly ~~the~~ a vortex enlarges. Step 3 illustrates a state where 0.3 second has further lapsed from Step 2. In this state, that vortex exfoliates and flows away to the back side. Simultaneously with this, it has been observed that a vortex (15) occurs at a ~~the~~ right/lower position of the network structure of x-shaped meshes. In Step 4, this vortex (15) enlarges and in Step 5, ~~that~~ the vortex (15) exfoliates.

In that way, the exfoliation of a vortex periodically occurs to thereby cause the occurrence of the flip-flop phenomenon that vertically vibrates the jet flow at the backward opening of ejection.

Also, in the flows in the interiors of the network grooves that are formed by a plurality of the crossed grooves, not only the periodic vibration phenomena of the jet flow that occurs at the network terminal, but also the interaction between the pieces of ejection of the fluid occur in various ways. That interaction includes, for example, the appearance of the Lamb effect (the ultrasonic vibrations appearing on the surface of a

small-thickness solid), the vibration phenomenon of a shear layer caused to appear due to the conflict between the pieces of flow, the attraction characteristic appearing due to the detouched vortexes, and the Coanda effect.

Hereinafter, an embodiment of the present invention will be ~~shown~~ discussed below and the invention will be explained in more detail.

Example

Using actually the stabilizing device for a slit fluid jet according to the present invention, a slit fluid jet was formed and its behavior was observed.

In this device, the width was ~~1 m~~ 1,000 mm, the angle of the grooves was 15 degrees, the width of the grooves was 2 mm, the depth thereof was 1 mm, and the clearance between the network structure of x-shaped meshes and the surface having no such network structure was ~~made~~ 0.5 mm.

When water was jetted from the slit at a flow speed of 0.5 m/s, a stable film of water with no broken portion existing therein was formed over a length of 1000 mm. In addition, the thickness of ~~that~~ the water film on an upstream side thereof was substantially the same as that of ~~it~~ the thickness on a downstream side thereof. The amount of flow of water at that time was 30 liter/min.

On the other hand, regarding an ordinary slit fluid jet having surfaces and having no network structure, experiments were conducted with the flow rate being ~~made~~ the same. As a result, breakage occurred at ~~the~~ a position in the vicinity of 20 mm and, at the same time, the thickness of the water film became extremely ~~great~~ large toward

the downstream side ~~of it~~. In order to ~~To~~ make the stable liquid film ~~keep~~ extending up to a position 1000 mm downstream ~~of it~~ when the liquid film ~~it~~ was prepared from the ordinary slit fluid jet, an amount of flow of water of 200 liter/min. was needed.

Using air, the same experiment as in the case of water was conducted at the flow speed of 5 m/s. The resulting air jet was visualized using an argon laser sheet. In the case of the ordinary slit fluid jet, a breakage phenomenon occurred at a position 15 mm downstream of the film, whereas, in the case of the slit fluid jet flow ejected from the present invention ~~of this application~~, a stable air film was formed up to a position 650 mm downstream of the film ~~it~~.

Industrial Applicability

As has been explained above in detail, according to the present invention ~~of this application~~, a stable fluid film is formed from the opening of ejection over a long distance with the slit fluid jet being not broken ~~in the~~ mid-course ~~of it~~.

ABSTRACT

~~A method and device for forming~~ a fluid film is formed stably over a long distance from a nozzle without breaking a slit fluid jet by allowing fluid flow out from a slit to form a slit fluid jet. ~~superimposing~~ a crossed flow is superimposed causing a flip-flop phenomenon upon the slit fluid jet. ~~and making the~~ energy of a ~~the~~ fluctuation velocity component of the slit fluid jet is ~~be~~ absorbed into a ~~the~~ vibration component of a flip-flop crossed flow so as to form a stable fluid film.

Version with Markings to Show Changes Made

CLAIMS

(Amended)
said method
1. A method of stabilizing a slit fluid jet, comprising
superimposing a fluid jet accompanied with a flip-flop phenomenon
at least surface/ the
upon one[, or both, of the surfaces] of [a] slit fluid jet and thereby
forming a stable [said] slit fluid jet.

(Amended)
having surfaces
said
2. A stabilizing device for stabilizing a slit fluid jet, [the]
and New ¶
stabilizing device [being adapted to stabilize the slit fluid
New ¶ a first flat plate; a second flat plate, wherein ← New ¶
jet of claim 1,] comprising [being equipped with two flat plates
said first flat plate and said second flat plate New ¶ said first flat plate has
that] oppose[s] each other with a prescribed gap in between, [one
of the flat plates of the slit having] an opposing surface that
and said second flat plate has with
is smooth, [the other having] a network structure [that has] a
New ¶
plurality of crossed grooves that are crossed like a letter x.

(Amended)
3. A stabilizing device [for stabilizing a slit fluid jet]
said network structure, said plurality
according to claim 2, wherein at an outlet of [the fluid there]
of crossed grooves such
are disposed [flow passages of the network structure so] that [the]
passing therethrough are
fluids [may be] merged [in].

Twice

4. (**Amended**) A stabilizing device [for stabilizing a slit fluid jet] according to claim 2,

at a — where said plurality of crossed grooves cross each other a detouched vortex occurs

wherein [the length between an detouched vortex, occurring to the] back of [the crossed groove portion], and a point to [that] the detouched [vortex] has been shifted is equal to or greater than [the] length of one side of a diamond-shaped protruding portion that is formed by [the x-shaped] grooves.

a length between the detouched vortex and — a — where — at least a portion of said plurality of crossed

Please add the following new claim:

Amended

5. (~~New~~) A stabilizing device [for stabilizing a slit fluid jet] according to claim 3, wherein

at a — where said plurality of crossed grooves cross each other a detouched vortex occurs

[the length between an detouched vortex, occurring to the] back of [the crossed groove portion], and

ATTACHMENT D

a length between ~~of~~ of the detached vortex and

a point to [that] the detouched vortex has been shifted is equal to or greater than [the] length of one

where

a

side of a diamond-shaped protruding portion that is formed by [the x-shaped] grooves.

at least a portion of said plurality of crossed